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Dnyaneshwari K Kankal
PG Scholar, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

SM Nawlakhe
Assistant Professor of Agronomy, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

VS Khawale
Professor, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

YV Deshmukh
PG Scholar, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

SR Rathod
PG Scholar, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

Corresponding Author:
Dnyaneshwari K Kankal
PG Scholar, Agronomy Section, College of Agriculture, Nagpur, Maharashtra, India

Effect of integrated nutrient management on yield and economics of summer sesame (*Sesamum indicum* L.)

Dnyaneshwari K Kankal, SM Nawlakhe, VS Khawale, YV Deshmukh and SR Rathod

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Abstract
A field experiment entitled "Effect of integrated nutrient management on yield and economics of summer sesame (*Sesamum indicum* L.)" was conducted at Agronomy farm, College of Agriculture, Nagpur during summer season of 2024.

Summer sesame was grown on clay soil, medium in nitrogen, low in phosphorous and rich in potash having pH 7.8. The experiment was laid out in randomized block design with nine treatments T_1 - 100% RDN (25 kg ha^{-1}), T_2 - 75% RDN + 25% N through FYM, T_3 - 75% RDN + 25% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_4 - 75% RDN + 25% N through Vermicompost, T_5 - 75% RDN + 25% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_6 - 50% RDN + 50% N through FYM, T_7 - 50% RDN + 50% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_8 - 50% RDN + 50% N through Vermicompost, T_9 - 50% RDN + 50% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed.

Yield attributing characters *viz*., number of capsule plant^{-1}, number of seeds capsule^{-1} and seed yield plant^{-1} along with seed and straw yield (q ha^{-1}) recorded significantly higher with application of 100% RDN (25 kg ha^{-1}) and found at par with application of 75% RDN + 25% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed. The highest GMR, NMR and B:C ratio of summer sesame were recorded with application of 100% RDN (25 kg ha^{-1}).

Keywords: Summer sesame, RDN, FYM, vermicompost

Introduction

Sesame is ancient oilseed crop with long history of cultivation. Sesame (*Sesamum indicum* L.) with family Pedaliaceae is known as "Queen of Oilseed Crops" by virtue of excellent quantity of oil and its use in domestic purpose meeting the oil need of country. It is considered to have both nutritional and medicinal values. The oil content varies from 48 - 52 % and contains 6355 Kcal kg^{-1} energy in seeds. The seeds are also rich source of proteins *i.e.* 20 -28%, sugar 14 -16% and minerals 5 -7% (Dhinosa and Gupta, 1973) [2].

Widely cultivated, the sesame plant is found in most of the tropical, subtropical and southern temperate areas of the world. Sesame is cultivated in all three seasons *viz. kharif, rabi* and summer. It has recently emerged as a valuable crop. Currently, this crop is giving much prosperity to the farmers of Vidarbha region.

As compared to the consumption of sesame, the production is less due to various constraints like improper land preparation, lack of soil fertility, use of low-quality seeds and most important one among them is imbalance in nutrient management and indiscriminate use of agrochemicals. This prolonged use of chemical fertilizer leads to deterioration of soil physical, chemical and biological properties. Hence to increase productivity on sustainable basis, the application of integrated nutrient supply is becoming popular as it is scientifically sound and assures sustainable development in agriculture. It includes both organic and inorganic sources along with biofertilizers. Now a days when the prices of inorganic fertilizers are racking high, there is necessity for integrating the chemical fertilizers with biofertilizers.

FYM is used to maintain soil productivity as well as, it is a good source of nutrients to plants. Vermicompost application has been known to improve physical, chemical and biological properties of soil. *Azotobacter* improves seed germination and has beneficial response on crop growth.

PSB solubilizes the unavailable bound phosphates of the soil and makes them available to plants, which increases overall plant growth as well as yield by 10 to 15% (Parmar *et al*., 2022) [6]. Application of vermicompost at 2 tonnes ha^{-1} provides significant increase in oil yield in summer sesame. Integrated application of nutrients (75% RDF + *Azotobacter* + PSB + KSB + VAM 0.25 Kg ha^{-1}) significantly increased yield and quality parameters. (Rathod *et al.,* 2024) [7].

Thus, keeping the above facts in view, the experiment was conducted to study the effect of integrated nutrient management on yield and economics of summer sesame (*Sesamum indicum* L.).

Material and Methods

An experiment was conducted at Agronomy Farm, College of Agriculture, Nagpur during summer seasons of 2024. The soil of the experimental site was clayey in texture, medium in nitrogen, low in phosphorous and rich in potash having pH 7.8. An experiment was laid out in randomized block design with nine treatments and three replications. Treatments under study were T_1 - 100% RDN (25 kg ha^{-1}), T_2 - 75% RDN + 25% N through FYM, T_3 - 75% RDN + 25% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_4 - 75% RDN + 25% N through Vermicompost, T_5 - 75% RDN + 25% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_6 - 50% RDN + 50% N through FYM, T_7 - 50% RDN + 50% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed, T_8 - 50% RDN + 50% N through Vermicompost, T_9 - 50% RDN + 50% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed.

White seeded sesame variety PKV NT -11 was sown at a spacing of 30 x 10 cm^2. Before sowing, sesame seeds were inoculated with Azotobacter 25 g and PSB 25 g kg^{-1} seed. FYM and vermicompost were applied 10 days before sowing for them to have thoroughly mixed with soil.

The data on yield attributes as well as yield were recorded at harvest.

Results and Discussion

Yield attributes: Yield attributing characters *viz.*, no. of capsules plant^{-1}, no. of seeds capsule^{-1} and seed yield plant^{-1} (Table1) recorded maximum and significantly superior over rest of treatments higher values in 100% RDN (25 kg ha^{-1}) (T_1) which was at par with treatment 75% RDN + 25% N through vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed (T_5). However, test weight remained uninfluenced due to various N levels and integrated nutrient management treatment.

Higher doses of nutrients increase their availability to the plant. Sufficient and well-proportioned nutrition also might have boosted vegetative development, growth and blooming, leading to enhanced yield attributes. Similar results were found by Mahajan *et al.,* (2013) [4] and Takar *et al.,* (2017) [9].

The maximum and significantly higher seed yield (6.99 q ha^{-1}) and stover yield (28.17 q ha^{-1}) (Table 2) was recorded with 100 % RDN (25 kg ha^{-1}) (T_1) receiving full recommended nitrogen dose but it was statistically similar with treatment having 75% RDN + 25% N through vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed (T_5). Nitrogen and phosphorus are the two major plant nutrients, vermicompost and biofertilizers might have increased their availability from insoluble and benefited the plant better with efficient utilization resulting in better vegetative and reproductive growth which might have ultimately resulted in higher seed yield. These results are in confirmity with the findings of Nahar *et al.,* (2023) [5].

Economics: Application of 100 % RDN (25 kg ha^{-1}) (T_1) resulted in significantly higher gross and net monetary returns (Rs. 76697 ha^{-1} and Rs. 65954 ha^{-1} respectively) (Table 2) and proved significantly superior over rest of the treatments. Maximum benefit: cost ratio of 4.18 was recorded with application of 100% RDN (25 kg ha^{-1}) (T_1) followed by 75% RDN + 25% N through vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed (T_5). Similar results were found by Ghodke *et al.,* (2014) [3] and Sharma *et al.,* (2018) [8].

Table 1: Effect of integrated nutrient management on yield attributes of summer sesame

Treatments	Number of capsules plant^{-1}	Number of seeds capsule^{-1}	Seed yield plant^{-1} (g)	Test weight (g)
T_1 - 100% RDN (25 kg ha^{-1})	51.33	62.67	8.58	3.30
T_2 - 75% RDN + 25% N through FYM	46.33	49.33	6.95	3.12
T_3 -75% RDN + 25% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed	48.63	54.23	7.99	3.25
T_4 - 75% RDN + 25% N through Vermicompost	46.66	49.67	7.19	3.28
T_5 - 75% RDN + 25% N through Vermicompost + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed	49.68	58.70	8.17	3.36
T_6 - 50% RDN + 50% N through FYM	44.48	47.74	5.61	2.80
T_7 - 50% RDN + 50% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed	45.26	48.71	6.14	2.99
T_8 - 50% RDN + 50% N through Vermicompost	45.11	48.35	5.93	2.89
T_9 - 50% RDN + 50% N through Vermicompost +*Azotobacter* 25 g + PSB 25 g kg^{-1} seed	48.44	54.87	7.77	3.21
SE(m) ±	0.56	1.60	0.42	0.2
CD at 5%	1.69	4.80	1.27	NS
GM	47.28	52.69	7.14	3.13

Table 2: Effect of integrated nutrient management on yield and economics of summer sesame

Treatments	Seed Yield (q ha^{-1})	Stover Yield (q ha^{-1})	GMR (Rs. ha^{-1})	NMR (Rs. ha^{-1})	Benefit: Cost ratio
T_1 -100% RDN (25 kg ha^{-1})	6.99	28.17	86697	65954	4.18
T_2 - 75% RDN + 25% N through FYM	6.05	26.09	75809	51443	3.11
T_3 - 75% RDN + 25% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed	6.43	26.92	79852	55466	3.27
T_4 -75% RDN + 25% N through Vermicompost	6.14	26.20	77220	52604	3.13
T_5 - 75% RDN + 25% N through Vermicompost +*Azotobacter* 25 g + PSB 25 g kg^{-1} seed	6.59	27.21	81598	59064	3.31
T_6 - 50% RDN + 50% N through FYM	5.40	25.60	67320	39282	2.40
T_7 - 50% RDN + 50% N through FYM + *Azotobacter* 25 g + PSB 25 g kg^{-1} seed	5.91	25.95	73514	45466	2.62
T_8 - 50% RDN + 50% N through Vermicompost	5.86	25.78	71738	46428	2.51
T_9 - 50% RDN + 50% N through Vermicompost +*Azotobacter* 25 g + PSB 25 g kg^{-1} seed	6.36	26.63	78942	50397	2.76
SE(m) ±	0.13	0.32	1665	1665	--
CD at 5%	0.41	0.97	4992	4992	--
GM	6.21	26.50	76961	51556	3.03

Conclusion

On the basis of the field experimentation, it is concluded that, in respect of the yield and yield attributes the application of 100% RDN (25 kg ha^{-1}) resulted in significantly higher yield over all the integrated nutrient management treatments but was at par with the application of 75% RDN + 25% N through Vermicompost + Azotobacter 25 g + PSB 25 g kg^{-1} seed. Application of 100% RDN (25 kg ha^{-1}) recorded highest gross monetary returns, net monetary returns and benefit: cost ratio among all the treatments.

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